

# Effects of Shiftwork on Lifestyle and Mental Health Status of Employees of a Major Japanese Electrical Manufacturer

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## Abstract

To examine the effect of shiftwork on lifestyle and mental health, a self-administered questionnaire survey was conducted among employees of a leading electrical appliances manufacturing company in Japan. The questionnaire included eight health practices recommended by Morimoto, the General Health Questionnaire-28 (GHQ-28) and demographic variables. Considering the effects of type of occupation, working hours and gender, analysis was focused on 295 male blue-collar mere employees working less than 8 hours per day and engaged in daytime work or two-shift work.

Scores for Health Practice Index (HPI) and physical exercise of shift workers were significantly lower than those of daytime workers for those from 30 to 45 years of age ( $p < 0.05$ ). However, in scores for HPI and each lifestyle factor, no significant difference was found among shift workers and daytime workers 29 or younger and 46 and older. In scores for the total GHQ-28 and its four subscales, no significant differences were found among shift workers and daytime workers 29 or younger, between 30 and 45, and 46 years of age and older. No significant effect of shiftwork was found on mental health status and lifestyle practices excluding physical exercise.

The findings suggested reduction of physiological and psychological stress due to shiftwork among employees of the major company. However, the effect of shiftwork on lifestyle practices and mental health status might be affected by various factors. Therefore an investigation of the work load in regard to shiftwork should be conducted precisely in the future.

**Key words:** Shiftwork, Lifestyle, Health practice, Mental health status, General health questionnaire-28

## Introduction

After invention of electric-power plants at the end of the 19th century, it became possible to use a steady and reliable source of power throughout the day and night, making of round-the clock equipment and service operations possible. This resulted in a dramatic increase in the practice of using two or more shifts of workers to carry out operations exceeding the length of a normal workday throughout industrial nations<sup>1)</sup>. Therefore investigation concerning the effect of shiftwork on personal lifestyle and mental health status is important. Previous investigations reported the effect of shiftwork on personal lifestyle,

physical health status and mental health status<sup>2,3)</sup>. Increased strain associated with shiftwork on the worker has been reported to cause sleep disorders<sup>1,4-6)</sup>, physical dysfunction<sup>6,7)</sup>, exacerbation of personal health status<sup>8,9)</sup>, disadvantage of social well-being<sup>1)</sup> and psychological problems<sup>10)</sup>. Based on these studies, Rutenfrantz et al.<sup>11,12)</sup> proposed better shift systems. In Japan, the Committee for Shiftwork of the Japanese Society for Occupational Health<sup>13)</sup> advocated guidelines for night work and shiftwork. Governments, companies and unions have attempted to improve working conditions of shift workers following these guidelines<sup>2,14)</sup>.

Lifestyle factors are known to be influential in the onset and prognosis of adult diseases<sup>15)</sup>. Breslow et al.<sup>16,17)</sup> demonstrated that seven health practices (not smoking, limiting the amount of alcohol consumption, sleeping 7 to 8 hours per night, eating breakfast regularly, not snacking, maintaining a desirable weight and exercising regularly) are associated with physical health status and mortality. Considering the Japanese cultural background, Morimoto et al.<sup>15)</sup> revised the list of seven health practices to a list

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**Table 1** Eight health practices recommended by Morimoto.

Items	Good practices (1 point)	Poor practices (0 points)
Exercise	Once a week or more	Less than once a week
Alcohol consumption	Sometimes or never	Almost every day
Smoking status	Not smoking	Smoking
Sleeping hours	7-8 hrs./night	Others
Nutritional balance	Balanced	Not balanced
Eating breakfast	Every day	Sometimes or not
Working hours	≤9 hrs./day	≥10 hrs./day
Subjective stress	Moderate	Too much or too little

of eight health practices for Japanese respondents. Table 1 shows these eight health practices recommended by Morimoto and their corresponding good health practice criteria<sup>15)</sup>. We demonstrated the relationship between these eight health practices and sister chromatid exchange<sup>18, 19)</sup>, natural killer cell activities<sup>20)</sup>, IgE<sup>21)</sup>, mental health status<sup>22-24)</sup> and working-life satisfaction<sup>24, 25)</sup>.

Personal lifestyle habits and mental health status are influenced by many factors, including working conditions, the shift system, working hours, the type of job, job position, gender, personal health status and social background at the time<sup>6, 26-28)</sup>. Therefore, occupational health problems and the health strategies of shift workers are affected by those factors. To investigate the effect of shiftwork on lifestyle habits and mental health status in recent years among Japanese employees, a questionnaire survey was conducted among Japanese employees at an electrical appliances manufacturing company after controlling for those factors.

## Materials and methods

### Materials

A self-administered questionnaire survey was conducted among 2310 employees at one of the top electrical appliances manufacturing companies in Japan located in a suburb of Osaka between June and July 1993. Almost all employees were healthy, but some were in good health because of treatment by the medical section of the company, or well-controlled patients receiving hospital care. No employee had serious health problems. A total of 2218 workers (96%) responded to the survey. We focused on the effect of shiftwork on personal health practices and mental health status in this study. Therefore we excluded female employees from this analysis, because no female employees engaged in shiftwork. There were so few workers engaged in three-shift work that we also excluded three-shift workers. Working hours, type of job and job position were closely related to personal health practices and mental health status<sup>6, 26-28)</sup>. We also excluded employees engaged in clerical, technical and managerial work (division chief, section chief and job leader) and employees working more than 9 hours per day. Further analysis was conducted on a total of 295 blue-collar employees who were engaged in two-shift work and daytime employees working less than 8 hours per day. Among the 295 male employees, 193 were shift workers and 102 were daytime workers. The mean ( $\pm$ standard deviation) ages of the shift and daytime workers were 28.8 $\pm$ 9.4 and 35.7 $\pm$ 10.3 years, respectively.

### Methods

A questionnaire was given to employees during the annual

physical examination at the workplace performed between June and July 1993. They were asked to complete the questionnaire and to return it after the physical examination. The form consisted of questions concerning demographic variables, personal health practices and mental health status. The demographic variables consisted of gender, age, marital status and type of job.

### Measurement of personal health practices

Items concerning personal health practices were related to the eight health practices recommended by Morimoto<sup>15)</sup> as shown in Table 1. Each item had multiple answers (3 to 5), and the answers were dichotomized into the categories of "good" or "not good" health practices as shown in Table 1. Answers in the "good" category received 1 point, and those in the "not good" category received 0 points. Scores from the eight items were totaled to provide an index of cumulative personal health practices, that is the Health Practice Index (HPI; 0-8 points). The more favorable the personal health practices, the higher the HPI score became. Because we focused on the employees working less than 8 hours per day, the scores for working hours were 1 point for all subjects, and the HPI scores were at least 1 point. Therefore, the scores for working hours were omitted from the analysis.

### Measurement of mental health status

The grade of mental health status was measured by the 28-item version of the General Health Questionnaire (GHQ-28)<sup>29)</sup> which effectively measures mental health status. The GHQ-28 provides four subscales (somatic symptoms, anxiety and insomnia, social dysfunction and severe depression). These subscales consist of seven questions each, and the GHQ-28 consists of twenty eight questions overall. Items were scored using Likert-type 1-2-3-4 scoring for response categories, and these were converted into 2-point scores of 0-0-1-1. The sum of the seven scores in each category indicating the points in each category (0-7 points), and the sum of all 28 questions on the GHQ-28 served as the score of the total GHQ-28 (0-28 points). The worse the personal mental health status was, the higher the scores on the GHQ-28 became.

### Method of analysis

The scores of HPI, each lifestyle factor, the total GHQ-28 and its four subscales were compared between shift workers and daytime workers. HPI became higher and the GHQ-28 became lower with age, and the mean ages of shift workers and daytime workers were significantly different. Therefore each shift worker and daytime worker was categorized into one of three groups (29 or younger, from 30 to 45 and 46 and over) divided by age. We examined the differences of HPI, each lifestyle category except for working hours, the total GHQ-28 and its four subscales among shift workers and daytime workers of each age group by t-test.

These analyses were conducted using the Statistical Package for Social Science (SPSS) computer program at the Computation Center of Osaka University.

## Results

### Effect of shiftwork on lifestyle

Figure 1 shows the distribution of the HPI scores by shiftwork. The mean ( $\pm$ standard deviation) scores for HPI of the shift

Table 2 Mean scores on HPI and health practices by type of job and age.

	Exercise	Alcohol consumption	Smoking	Sleeping hours	Nutritional balance	Eating breakfast	Subjective stress	HPI
[under 29 yrs.]								
Daytime worker (N=35)	0.63±0.49	0.89±0.32	0.46±0.51	0.31±0.47	0.09±0.28	0.51±0.51	0.57±0.50	4.46±1.42
Shift worker (N=136)	0.54±0.50	0.84±0.37	0.36±0.48	0.30±0.46	0.07±0.26	0.49±0.50	0.66±0.48	4.27±1.23
t value	0.89	0.69	1.05	0.15	0.24	0.23	-0.99	0.77
[30-45 yrs.]								
Daytime worker (N=49)	0.43±0.50	0.71±0.46	0.41±0.50	0.43±0.50	0.24±0.43	0.67±0.47	0.57±0.50	4.47±1.43
Shift worker (N=40)	0.23±0.42	0.53±0.51	0.28±0.45	0.33±0.47	0.20±0.41	0.63±0.49	0.68±0.47	3.85±1.33
t value	2.05*	1.85	1.31	0.99	0.50	0.47	-0.99	2.10*
[over 46 yrs.]								
Daytime worker (N=18)	0.50±0.51	0.33±0.49	0.50±0.51	0.44±0.51	0.39±0.50	0.94±0.24	0.67±0.49	4.78±1.44
Shift worker (N=17)	0.47±0.51	0.41±0.51	0.47±0.51	0.71±0.47	0.24±0.44	0.76±0.44	0.82±0.39	4.88±1.22
t value	0.17	-0.47	0.17	-1.57	0.96	1.53	-1.05	-0.28

t value was computed by t-test

\*p<0.05

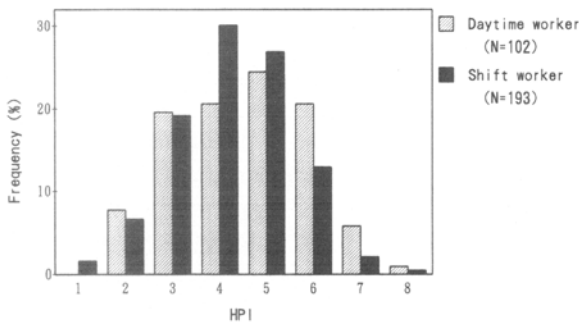


Fig. 1 Distribution of scores for HPI.

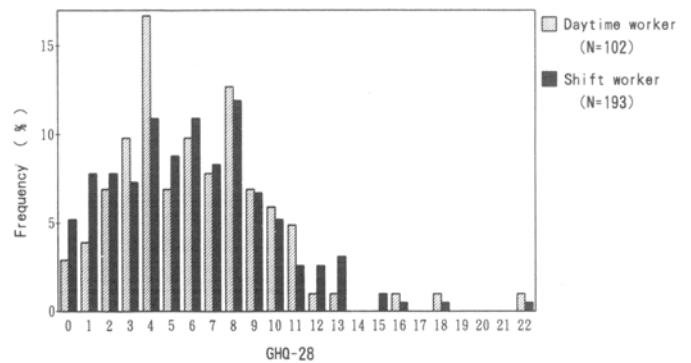


Fig. 2 Distribution of scores for the total GHQ-28.

and daytime workers were 4.24±1.27 and 4.52±1.42, respectively. Table 2 shows the mean values and standard deviations of the HPI scores and each lifestyle factor by shiftwork and age. The scores for HPI and physical exercise of shift workers were significantly lower than those of daytime workers between 30 and 45 years of age (p<0.05). However, no significant difference was found in scores for alcohol consumption, smoking, sleeping hours, nutritional balance, eating breakfast and subjective stress among the shift workers and daytime workers between 30 and 45 years of age. In scores for HPI and each lifestyle factor, no significant differences were found among the shift workers and daytime workers 29 and under and those 46 years of age or older.

Effect of shiftwork on mental health status

Figure 2 shows the distribution of scores for the total GHQ-28 by shiftwork. The mean (±standard deviation) scores for the total GHQ-28 of the shift and daytime workers were 5.79±3.49 and 6.18±3.74., respectively. Table 3 shows the mean values and standard deviations of the scores for the total GHQ-28 and its four subscales by shiftwork and age. In scores for the total GHQ-28 and its four subscales, no significant differences were found among the shift workers and daytime workers 29 and

under, those from 30 to 45 and those 46 years of age and older. Although no difference was found, the scores for the total GHQ-28 of shift workers 29 and younger were higher than those of daytime workers, and those of shift workers between 30 and 45 and over 46 years of age and older were lower than those of daytime workers.

Discussion

Recently, shiftwork has become common in the food, medical services, police, fire, safety and transportation services, in certain industries where the technical processes cannot be interrupted without deterioration or destruction of the product, and in industries where expensive equipment can only be used profitably when in constant operation<sup>1)</sup>. In the United Kingdom, the proportion of shift workers among workers engaged in operation of equipment rose from 12 per cent to 20 per cent between 1957 and 1964. In France, 21.9 per cent of workers engaged in shiftwork in 1974. In the United States, 26.9 per cent of workers did so in 1976. Even in Japan, the proportion of shift workers is gradually growing with the development of industry. Estimates

**Table 3 Mean scores of the total GHQ-28 and its four subscales by type of job and age.**

	Somatic symptoms	Anxiety-Insomnia	Social dysfunction	Severe depression	Total GHQ-28
[under 29 yrs.]					
Daytime worker (N=35)	1.09±1.10	0.69±1.08	3.80±2.21	0.06±0.24	5.63±3.26
Shift worker (N=136)	1.20±1.17	0.69±1.13	4.10±2.04	0.10±0.34	6.09±3.40
t value	-0.51	-0.03	-0.77	-0.63	-0.72
[30-45 yrs.]					
Daytime worker (N=49)	1.45±1.47	0.73±1.46	4.37±2.14	0.47±1.17	7.02±4.34
Shift worker (N=40)	0.98±1.33	0.58±1.04	4.23±1.97	0.15±0.43	5.93±3.50
t value	1.58	0.58	0.32	1.63	1.29
[over 46 yrs.]					
Daytime worker (N=18)	0.89±1.08	0.44±0.78	3.56±1.62	0.06±0.24	4.94±2.07
Shift worker (N=17)	0.59±0.94	0.18±0.39	2.29±2.05	0.06±0.24	3.12±3.22
t value	0.88	1.27	2.02	-0.04	2.01

t value was computed by t-test.

are that 12.8% of the employees did some form of shiftwork or night work in 1979<sup>14</sup>). In the present day, the prevalence of shift workers has been growing with the development of factory automation, especially in the electronics and semiconductor industries.

Many previous investigations have indicated the relationship between shiftwork and lifestyle practices and physical health status<sup>2,3</sup>). In particular there have been numerous studies of the physiologic and health consequences of shiftwork and the relationship of shiftwork to accidents, social well-being<sup>1</sup>), productivity, absenteeism<sup>8</sup>) and circadian rhythms<sup>2,3</sup>). Shift workers are known to have an increased prevalence of gastric and intestinal dysfunctions<sup>3</sup>), exacerbation of chronic medical conditions<sup>8,9,11</sup>) and sleep disturbances<sup>1,4-6</sup>), although there has been uncertainty regarding both long-term health effects and the role of personal factors in adaptation to shiftwork<sup>3</sup>). A certain proportion of shift workers do not show an obvious deterioration in health<sup>3</sup>). A previous study indicated that some people even prefer shiftwork to other kinds of work<sup>7</sup>). The best-documented effect of shiftwork is sleep disorders. Frase et al.<sup>4</sup>) reported shortened sleeping hours of night-and morning-shift workers. Tune et al.<sup>5</sup>) suggested the necessity of longer sleep by the shift workers to pay off specific kinds of sleep debt. Shift workers are also more likely to report disrupted eating habits and poorer diets than daytime workers<sup>1</sup>). Yamaguchi et al.<sup>7</sup>) reported higher consumption of alcoholic beverages and cigarette among shift workers. Gordon et al.<sup>1</sup>) reported higher rates of heavy drinking and job stress among those working variable shifts compared to working non-variable shifts, and higher rates of sleeping pill and alcohol use in female variable shift workers.

However, in this investigation, no significant differences were found in regard to smoking, alcohol consumption, sleeping hours, nutritional balance, eating breakfast and subjective stress among shift workers and daytime workers of each age group.

This was in contrast to previous studies, and might be due to a difference of lifestyles of workers, working conditions including working hours, the shift system, and the development of automation in industry. There might also be a difference of social background, including the development of electrical appliances for the house such as the popularization of air-conditioners, progressive urbanization and widespread use of the automobile. This might be because workers were employed in a major companies in which working conditions (working hours, shiftwork allowance, shift system, etc.), welfare facilities (resting rooms for shift workers, etc.), the health support system (medical checks for shift workers, etc.), and social support were substantial. Generally in Japan, the larger the company becomes, the better these conditions become. However, shift workers from 30 to 45 years of age had better health practices than daytime workers in regard to physical exercise and HPI. This indicated that workers between 30 and 45 age were so busy that they had no time for physical exercise, which requires time and often money to do regularly. The influence of physical exercise on shiftwork may be different with age.

The relationship between shiftwork and mental health status has been reported<sup>3</sup>). Rutenfranz et al.<sup>11,12</sup>) reported the association between shiftwork and onset of neurosis. Kawakami et al.<sup>10</sup>) reported that shiftwork influenced the Zung self-rating depression scale (SDS) scores of industrial workers. Gordon et al.<sup>1</sup>) reported higher rates of emotional problems among variable shift workers compared to non-variable shift workers. However, Kawada et al.<sup>30</sup>) reported that the mean value of the SDS index by age, distribution of the SDS index and factor structure of the SDS questions of night and shift workers were similar to those of daytime workers.

In this study, no significant differences were found between shift workers and daytime workers in regard to mental health status. This contrast with previous investigations, might have been

due to a difference of lifestyles of the workers, working conditions and social background. Or because the workers studied were employed in a leading company in Japan. Although the difference was not significant, the mental health status of shift workers was better than that of daytime workers for those from 30 to 45 of years and those 46 and over. This indicated that mental stress in regard to shiftwork decreased as workers became accustomed to such work.

No significant effect of shiftwork was noted in regard to mental health status and lifestyle practices excluding physical

exercise. These findings suggested a reduction of physiological and psychological stress due to shiftwork among workers of a leading company in the present working condition and social background. Effects of shiftwork on lifestyle practices and mental health status were influenced by various factors, including working conditions and social background, and those factors changed with the time and the management state of the company. Therefore, the work load in regard to shiftwork should be further investigated in the future.

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(Received Jun. 24, 1996/Accepted Dec. 13, 1996)